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# Concept formation and development in the congenitally blind child

Kimberly J. Franco

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CONCEPT FORMATION AND DEVELOPMENT IN THE  
CONGENITALLY BLIND CHILD

Kimberly J. Franco  
Class: Honors Seminar  
Spring 1982

Advisor: Dr. William E. Walker

CONCEPT FORMATION AND DEVELOPMENT IN THE  
CONGENITALLY BLIND CHILD

Why can't I write with my eyes?  
Why did I always want to touch my  
mother? Where does the loving go  
when the scolding comes in the  
voice? Can you see the echo come  
back? What color is it when it is  
blue?<sup>1</sup>

T. D. Cutsforth once stated that "no single mental activity of the congenitally blind child is not distorted by the absence of sight."<sup>2</sup> Blindness permeates the intellectual functioning of language, thought, comprehension and conceptualization. Ultimately, the child lacking vision will both understand and respond to the world in a manner unlike that of a sighted child.<sup>3</sup> This incongruous interaction breeds frustration since the blind are a minority in a world which concentrates on the characteristics, needs, behaviors, and accomplishments of sighted individuals. Lacking the visual modality, the blind rely on the information about the objective world which they receive from people who see. Considering the incomplete picture resulting from second-hand knowledge, it hardly is possible to expect a steady cognitive process of the blind, undistorted by the material brought to bear on them from a sighted environment.<sup>4</sup>

To investigate concept formation and development in blind children, various components of cognitive functioning will be discussed, primarily from a Piagetian perspective. Beginning with an overview of the visual orientation of the sighted infant and the importance of this orientation

for concept development, the potential handicaps for the blind infant will be outlined. Progressing from an elaboration on the characteristics of and various types of concepts, special attention will be given to a comparison of sighted and blind individuals in the following areas: language, conceptualization of the self and the environment, concrete vs. abstract thinking, and most extensively, Piagetian tenants and stage theory.

Perception of complete experiences are limited by the absence of vision primarily because relatively few objects or events emit sound or smell, attracting the attention of the blind child. A bright colored object always is "available" to the sighted child in the visual sense. Unfortunately, the blind youngster lives in a state of "sensory deprivation" and does not share the same advantages.<sup>5</sup> The notion of limitations and restrictions on the learning experiences of the blind has a tremendous impact on the interaction of the blind child to the external environment. In addition to the recognition of and differentiation of stimuli, blind children have difficulties in gathering and collecting varied experiences about situations or events which lead to retarded development of adequate concepts.<sup>6</sup> Ultimately, the blind child "is delayed in his turning outward to the world."<sup>7</sup> This distinguishing feature in the orientation of the blind child begins in infancy and is understood most easily when compared to the development of visual communication in the sighted child.

As indicated by the response to external stimulation, it is clear that at birth infants can perceive the world around them. With age, the infant becomes increasingly organized in his/her perceptual experience.<sup>8</sup> The primal modality for this arrangement of experiences is vision. In 1877, Charles Darwin conducted a simple experiment to test infant vision.

He placed a candle in front of his son's eyes and found his son able to fixate on the flame. Nearly a century later, the technique used to measure infant fixations is the reflection of a visual target on the cornea of the eye.<sup>9</sup> The role of vision in the development of the child was investigated by Gesell et al (1934) and described by a variety of "regards" by the infant. "An infant regards spontaneously, momentarily after a delay, starily, consistently, recurrently, prolongedly and predominantly." Each type of visual attention is characteristic for the stage of development which has been reached.<sup>10</sup> The specific levels and a brief description of the defining idiosyncratic behaviors are listed below.

1 week	stare without fixation.
4-12 weeks	look at Mom's face; adult's hands and own hand, face brightens.
6 weeks	starey gaze, true inspection, follows retreating figure of Mom, moment of searching, more alert and adaptive.
16 weeks	protracted moment of staring, knows Mom, sobers over strangers.
24 weeks	recurrence of regard
28 weeks	perceptual behavior, interest in own ability, content to be alone, can concentrate on object.
40-57 weeks	inquisitive visual and motor behavior, intent on regarding what others do, perceptual moods.
52-56 weeks	imitation. <sup>11</sup>

The infant's reliance upon vision for orientation to and communication with the world also is elaborated on by G. W. Greenman in his book The Visual Behavior of the Newborn Infant. "One of the earliest ways in which the infant can communicate with [the world] is by looking . . . [this reaction] serves the infant "psychologically by giving more pleasures to the nurturing person, thus increasing the quality and frequency of stimulation."<sup>12</sup>

The importance of vision as providing a basis for perception in the infant cannot be overstated; however, with the maturation of the child, the reliance on vision for conceptual development is intensified.

"With each waking hour, the sighted child experiences [the] visual environment. [The] eyes reaffirm, correct, and expand [the] core of information. Long before he/she is capable of verbalizing information, the sighted child has established some concepts about the roof, walls, and floor of the house because he/she has explored them visually thousands of times."<sup>13</sup> Vision provides the most detailed and specific information concerning external phenomena and serves as a means of unifying all of the perceptual experiences gained through the other modalities. Since perceptual interaction with the world is imperative for conceptual growth, blindness inhibits the child by allowing him/her less information about the environment. The blind child lacks both the continuity of visual experiences and the regulatory function that vision provides.<sup>14</sup>

"Anyone who pauses long enough to give the problem some serious thought cannot escape the conclusion that man lives in a world of concepts rather than a world of objects, events, or situations. . . . Reality, figuratively speaking, is experienced through a conceptual or categorical filter."<sup>15</sup> A concept is an abstraction, a generalized symbol which incorporates all of the knowledge for a particular empirical object, event, or idea. The ability to think in terms of abstractions is a valuable instrument for predictions about future experiences.<sup>16</sup> Concept acquisition in the child has 3 components--each category assists the child in the identification and internalization of the specific concept.

- |                             |  |
|-----------------------------|--|
| 1. Functional core.         | Express essential, specific differential relations of thing or event in time or space.                         |
| 2. Optional or possible.    | Not necessarily general. Spatio-temporal relations of thing as child previously experienced.                   |
| 3. Identification features. | How to recognize; how newly encountered objects or events fall under previously formed concepts. <sup>17</sup> |

Conceptualization is a continuous process. Although the result often is a repertoire of relatively stable structures for experiences. The process is a fluid one.<sup>18</sup>

A child is forced into a world of unfamiliarity; hence, the youngster must concentrate on those facets of the environment bearing the most importance. The goal is to order the experiences in a way which will allow familiarity and predictability for subsequent encounters.<sup>19</sup> This organization of the child's interaction with events, objects, and ideas helps to secure an accurate understanding of characteristics, locations, as well as functions.<sup>20</sup> In essence, the child must develop concepts: the concepts vary on a continuum from concrete to abstract.

Concept formation may be divided into three levels: concrete, functional, and abstract. The schema of this approach is a graduated, additive progression.

- |                |   |
|----------------|---|
| 1. Concrete.   | The specific characteristics of object considered to be content.  |
| 2. Functional. | The function the object performs or what one does with the object.  |
| 3. Abstract.   | The general term connoting or summing up all essential or common characteristics of the object. <sup>21</sup> |

Normally beginning with the concrete stage, more descriptive and distinguishing features are added until the concept becomes increasingly general, symbolic, abstract. Another strategy for identifying and ordering the environment incorporates a social interactive component. Objects familiar to the child and events in which the child interacts with the object are the focus of early activity and are the first articles labeled. Examples of these "articles" include Mom, Dad, Granny, the family pet, food and drinks, and the animals learned from picture books.<sup>22</sup> With increasing maturity, socialization integrated with self-development and the appropriate physical experiences will encourage intellectual and conceptual growth.<sup>23</sup>

Our present understanding of the developmental stages and the level of conceptual functioning for the blind child is limited.<sup>24</sup> Blind children in general are characterized by varying cognitive styles and most demonstratively, by a lag in conceptual formation and maturation.<sup>25</sup> Heterogeneity in the rate of thought processing is not uncommon for blind children or sighted children; however, the degree and impact of variation in blind individuals is far greater. Research done by Hatwell (1966) on blind children indicated up to a four-year retardation for attaining specific concrete, manipulatory concepts.<sup>26</sup> An additional study conducted by Boldt (1969) "found blind children to progress through stages of cognitive development similar to those of sighted children, but at a delayed rate that is quite reminiscent of the delays in cognitive skills as measured by performance on Piagetian tasks."<sup>27</sup>

"Visual impairments do restrict several aspects of mental development, particularly the cognitive area."<sup>28</sup> Specifically, blindness prescribes the following three restrictions: in the range and variety of experiences, in



the ability to perceive the world independently, and in the control of the environment and the self.<sup>29</sup> Impediment in these spheres ultimately leads to incongruous development. Kephart, Kephart & Swartz (1974) conducted a comparative study of blind and sighted children between the ages of five and seven. The research was based on the responses to the Kephart Scale. Initially, the Kephart Scale was used to provide a method of assessment for the personal and environmental awareness of blind children. The spontaneous response of the blind and sighted to the body image (verbal construction) game revealed that in constructing an imaginary friend, the blind subjects mentioned fewer body parts at each age level. Figure 1 is based upon the parts of the body mentioned by at least 50 percent of the children. For each group, the head was the first answer. Curiously, the fingers and ears are not alluded to despite the importance of the tactile and auditory modalities for the blind. Results from the study reveal that blind children have "misformation, fragmented concepts, and a limited use of differentiation of information." Unlike the sighted child, the blind youngster is deprived of visual processing, severing a valuable means of gathering experiential knowledge of his/her surroundings. This deprivation is not compensated for adequately through the auditory or tactile modalities. In essence, Kephart's research supports a Gestalt Theory of information coding--optimally, an experience must be perceived wholistically, through the attention of all of the senses.<sup>30</sup> When the coding process is deficient, conceptualization suffers.

Referring back to the notion of concepts ranging on a continuum from concrete to abstract, this idea has been taken a step further, encompassing "articulation" and "global" thinking. A global perspective may be paralleled with concrete considerations of the environment while articulation is

"[related most closely] to abstract conceptual ability."<sup>31</sup> For the sighted child, normal cognitive development graduates from global to articulated; by the onset of puberty, "the abstract level of concept formation should be attained."<sup>32</sup> With age, children become more skilled at differentiating structures in a field and also are able to place structure and order when little exists.<sup>33</sup> The key to this skill is experience:

Experience is articulated, rather than global, if a person is able to experience parts of a field as discrete from background when the field is structured and able to impose structure on a field; therefore, experience is organized even when field has very little inherent structure.<sup>34</sup>

Articulation comprises two dimensions--analysis and structure--which are closely related to perception and intellectual ability. The perception element describes experiencing the arrangement of immediately present stimuli; intellectualizing refers to understanding symbolic representations.<sup>35</sup>

The powerful function of vision in articulation should not be surprising. Acquiring organization and meaning from abstract events is constrained when using modalities besides sight. In terms of cognitive orientation, the blind are expected to be more global than sighted persons.

Vision is the sensory channel more useful in the development of articulation. Accordingly, for blind children, this development is hindered.<sup>36</sup> The blind function primarily on a concrete level; they employ abstract concepts more infrequently than sighted individuals of the same age. Research by Tillman (1967) in which blind children of all ages were studied supports the idea of a concrete and functional approach to abstract problems.<sup>37</sup> Additional investigation by Higgins (1973) reinforces Tillman's findings. Higgins found that his blind subjects were "less able than sighted children to classify when abstract content was involved than when concrete

was involved." The subjects were between five and eleven years and had congenital blindness.<sup>38</sup> Abstraction requires a proficiency in distinguishing relevant qualities of a complex stimulus.<sup>39</sup> Lacking such expertise, the blind tend to more global in cognitive functioning.

The abstract versus concrete thinking paradigm for blind children was the focus of a notable study conducted by Zweibelson and Barg (1967). I. Zweibelson Ed. D. is a senior psychologist for the New Rochelle, New York School District; C. F. Barg, M.A. is a school psychologist for the Elment, Long Island, New York Public School System. Blind and sighted children were listed for their responses on the Similarities and Vocabulary scales of the Wechsler Intelligence Scale for Children (WISC). All children were eleven to thirteen years old and had varied IQ scores. Nearly all blind subjects had been blind from birth and in severity of blindness, were either completely blind or had light perception (LP) at most. Results from the experiment revealed "significantly more concrete and functional scores . . . by the blind group and more abstract scores . . . by the sighted."<sup>40</sup> Clearly, the visually handicapped have a retarded use of abstract thinking; requiring a developmental approach to cognitive maturation.

Jean Piaget, a pioneer in the field of human thought processes, revolutionized the study of child language and thought by examining child perception and logic systematically. Concentrating on peculiar traits of child cognition, Piaget contends that the youngster "is not a miniature adult and [his /hers] mind not the mind of an adult on a small scale;" the difference between an adult and child is not quantitative, but qualitative.<sup>41</sup> Piaget's repertoire of contributions to cognitive development is extensive; however, he is noted most frequently for his stage theory of development.

Piaget has generated the most inclusive analysis of conceptual acquisition and development within a graduated system.<sup>42</sup> Children integrate environmental stimuli into the existing cognitive framework. If the experience is new and contributes a different dimension to the present schema, then "thought patterns are modified or changed by accommodation."<sup>43</sup> Advancement is identified by this "active and unconscious structuring of input [that the child] perceives in the environment."<sup>44</sup>

Piaget's guide to cognitive development provides a categorized and universal standard for intellectual growth and is premised by six tenets.<sup>45</sup>

1. Cognitive development is a gradual, evolving process dependent upon social, emotional, and physical growth and cannot be understood in isolation;
2. Individual differences and patterns of growth influence functioning but are also affected by the sequence, variety, and quality of symbolic experiences;
3. Knowledge of reality must be discovered and constructed through the activities of the child at [his/her] cognitive structural level;
4. Activities promoting spontaneous exploration, either physical or intellectual, occur at all levels;
5. A cognitively oriented curriculum continuously develops and reinforces spatial-temporal and logical-mathematical reasoning;
6. Generative learning rests upon the child; spontaneity and creativity, whereas factual learning comes through practice, repetition, and memorization.<sup>46</sup>

The influence of these principles upon the child in the formative years provides the criteria for the specific stages of Piaget's cognitive process. Each of the levels--sensorimotor, preoperational, concrete operations, and formal operations--builds upon, reconstructs, and eventually exceeds the

preceding one.<sup>47</sup> Perceptual growth is a qualitative process, adding upon the existing conceptual framework. All individuals, sighted or blind, will progress through the stages in sequence, although blind children tend to move at a slower rate. "Blind children sequentially go through the same stages but [there is] disagreement in literature as to the age at which this is attained."<sup>48</sup>

The sensorimotor stage of cognitive development begins at birth and extends until approximately two years of age. Some defining features of this pre-verbal level include behavior progressing from simple reflexes to an internalized method of solving basic needs and desires, increased hand-eye coordination, and conceptualizing the permanence of objects. As is evident from the detailed outline of the sensorimotor period described below, there is a strong dependence on vision for normal development.<sup>49</sup>

1. Reflexes (birth to one month).  
Dominating the behavior of the infant are reflexive responses, both in response to the self as well as to the environment. Many of these reflexes are refined as the child interacts with the external world--some objects are "suckable" and some are not.
2. Primary Circular Reactions (1 to 4 months).  
The infant develops a repertoire of experiences or action which are pleasing, interesting, or satisfying to him/her; subsequently the child repeats these behaviors. Most often, the behaviors focus upon the child and not the environment.
3. Secondary Circular Reactions (4 to 8 months).  
In contrast to the infants actions being directed toward the self as in primary circular reaction, attention is given to satisfaction and pleasure through interaction with the environment.
4. Coordination of Secondary Circular Reactions (8 to 12 months).  
As the child becomes more adept at coordinating his/her behavior with the external world, "intentionality" emerges. In addition, the infant begins

to anticipate the results of his/her own actions and the actions of others. Combined, these new skills help the child to organize the world.

5. Tertiary Circular Reactions (12 to 18 months). A "trial and error" approach to exploring the environment as well as a flexibility in systematically altering actions to reach a goal demarcate this stage. The child seeks "novelty for the sake of learning more about the world."
6. Internalization of Thought (18 months to 2 years). Overt trial and error behavior patterns subside and an internalized evaluation of behaviors and potential effects begins to develop. For Piaget, this step is monumental because it "frees the child from [his/her] own perceptions and behaviors."<sup>50</sup>

Considering this sensorimotor paradigm, Sandler (1963) contends that blind children will be deficient in sensory continuity provided by visualization. Inevitably, the consolidation of the blind child's sensorimotor experiences will be frustrated.<sup>51</sup>

Cognitive processing for blind and sighted infants is comparable until the age of approximately four months.<sup>52</sup> Up until this time, reflex behaviors are not affected by visual impairments, nor are the repetitive responses to desirable stimuli. Interaction with the external world is minimal until the end of the second stage; therefore, the parallel progression for sighted and blind infants should not be surprising in these early stages. "Visual control of manual behavior" is an important characteristic of the third level. Ultimately, the conceptual patterns between sighted and blind children begin to digress. Evidence of the blind's stunted acquisition of secondary circular reactions--the failure to reach for objects--suggests a delay in the coordination of these secondary circular reactions. Impaired orientation to the environment does not permit adequate associations between the self and the world. It is at this stage that the blind infant

senses a handicap from the lack of vision. To overcome the deficit other senses become extremely important. "The tactile and auditory schemas begin to unite toward the end of this period."<sup>53</sup> Little evidence pertaining directly to the implications of visual impairment on the fifth and sixth stages is available. Nevertheless, the retarded capacity of the blind infant to impose structure on his/her surroundings will have a debilitating impact on the child's experimentation of and relative flexibility with the environment. Finally, "internalization of thought" is interdependent upon concept acquisition for regulating the blind child's perceptions and behaviors. Since conceptualization is impeded severely by the absence of vision, the blind infant will suffer during the sixth stage of sensorimotor development.

Sensorimotor development is altered most dramatically for blind children because of the tremendous amount of cognitive and perceptual growth taking place in the first two years of life. Still, it is necessary to recognize the other three stages of Piaget's theory: preoperational, concrete operations, and formal operations. The preoperational stage lasts from approximately two to six years of age, and it is denoted by the emergence of language. At this level, language serves a symbolic function--"verbal utterances internally linked to symbolic play, deferred imitations, and mental images." The preoperational child is ready to communicate discoveries and information about objects and events; he/she is satisfied no longer with simply reacting to the environment.<sup>54</sup> For the blind child too often the information perceived is incongruous with reality; the result is confused and unharmonious development.

In the concrete operational stage, the child internalizes data from the environment to be used for investigating problems. A popular concept

used to test for concrete operational thinking is conservation.<sup>55</sup> Conservation, the demarcation for this stage, refers to the ability of an individual to "retain correct judgment of the property even in the face of perceptual transformations."<sup>56</sup> To be successful, the child must be able to maintain a "state of equilibrium between . . . cognitive structures (schemas) and [his/her] perceptual information about the world."<sup>57</sup> The standard test for conservation is to present the child with two clay balls of the same size. After the child acknowledges the two objects as being equal in substance, the shape of one of the balls is altered, without adding or subtracting any clay. Finally, the child is asked to comment on the comparative substances. If the youngster says that the two objects still are equal, conservation is indicated.<sup>58</sup> Miller (1969) conducted research in 26 visually impaired children between the ages of six and ten. He blindfolded all subjects "to control for the amount of visual impairment," and had the children perform conservation tasks using both balls of clay and glass beakers of water. Miller found "that an increase in the ability to conserve was a function of age, although partially sighted subjects performed significantly better than the totally blind." His results strengthen the idea that vision is vital to the development of reasoning--"the importance of visual interaction with the environment as a factor in conservation."<sup>59</sup>

Formal operations, the last stage in Piaget's theory on cognitive development, is defined as developing proficiency in applying reason to hypothetical situations and using logic to control the environment.<sup>60</sup> Little or no research with respect to formal operations and the blind has been directed. It is safe to infer, however, that the construction of ideas and the reasoning about people and surroundings will be optimal only if a child



has the skills and experience to think in abstractions. Concrete thinking dominates the thought structure of blind children; their abstraction abilities are slow to develop and often inadequate. Hence, not only will blind children take sufficiently longer to reach the stage of formal operations, but once at this level, they will have considerable difficulty. Concluding the discussion on Jean Piaget's stage theory of cognitive maturation, it is appropriate to examine the four general factors which Piaget associates with cognitive enhancement--maturation, learning, social education, and equilibrium.<sup>61</sup>

"Maturation is concerned with growth, particularly physical growth, and the maturation of the central nervous system. It plays a role throughout mental development and is dependent upon action and experience; certain behaviors therefore depend upon the functioning of specific structures."<sup>62</sup> For normal and sighted children, motor development is homologous until approximately four months old. This parallel is quickly interrupted when the child begins to experiment with the environment.

The first major differences in development between the blind and sighted child [begin] to appear when the child's neuromusculature develops to the point where [he/she] is capable of controlled body movements. The sighted child is attracted by [his/her] environment as [he/she] begins to have direct sensory experience of it. The differentiation between self and environment begins to emerge at this point. By differentiating objects from one another, by manipulating these, and by observing [his/her] impact on them, the child is slowly able to distinguish the boundary between self and non-self.<sup>63</sup>

Neuromusculature growth in the blind child is hampered in three ways. First, the impressions of the environment which he/she can have first-hand perception of is restricted tremendously. Second, those fractions of the world which the blind child can understand experientially do not have the same "stimulus

value" for blind and sighted children. Third, the blind child has a limited regard for his/her influence upon objects manipulated.<sup>64</sup> Although Piaget never performed research on visually impaired children, he acknowledges that the blind are underprivileged since they cannot perform the same motor coordination activities "in space that sighted children can during the first two years. Inevitably, sensorimotor skills and general coordination of movements are critically inhibited. In addition, development in the stage of representational thinking is deterred and language is not adequate compensation for flaws in the synchronization of motions. Eventually, the lag is overcome, but the ramifications of such a considerable developmental dilemma cannot be overlooked."<sup>65</sup>

"Learning, the second factor of mental development, is essentially the role of experience, of concepts derived from the actions performed upon objects [and environment]."<sup>66</sup> Generally, concepts that an individual attains will be derived from a gamut of experiences. One's involvement with reality is never neutral. Observation implies interpretation, interpretation incorporating previous knowledge and values which are embedded with the culture and language.<sup>67</sup> Labeling of concepts is automatic exclusively to persons who have learned about their surroundings through exposure and structuring; symbols do not come first.<sup>68</sup> Competency in manipulating symbols describing objects, events, people, and places is the power of human intellect.<sup>69</sup> All children need to determine what functions and characteristics belong to a world--a symbol for a concept. "Long after [they] use the word for the first time, [they] are still acquiring attributes and experiential meaning of the word in various settings. [This will] continue until the conventional meaning is achieved."<sup>70</sup> The child must create in long-term memory (LTM) a

network of symbols, a consolidation of individual symbols as well as an understanding for the associations between each. When an object is presented, it will be placed into the network in the appropriate space.<sup>71</sup> This additive process of concept development is termed "horizontal vocabulary expansion."<sup>72</sup> Inasmuch as horizontal vocabulary expansion is built on an individual's encounters and perceptions, the notion of the "functional core" also is defined by exposure to the environment.

The "functional core" of an object or event has three elements. First, it qualifies the crucially important and useful roles of the object based on the individual's interaction with it. Second, it identifies the relationship of the object to the person's life experiences, not identification via perceptual imprints. Third, the functional core varies between individuals, especially among children and even more extensively between a child and an adult. As an example, consider the word "clock." For a child, the functional core for "clock" would include "noises, people, and location;" for an adult, it would be "time-keeping." Despite common descriptions for the object "clock," the functional cores are not the same.<sup>73</sup> Nevertheless, the functional core solves the problem of organizing important ingredients of on-going experiences into a unified representational concept, including identifying criteria which serves to differentiate between related concepts.<sup>74</sup> A child can respond to "dog" by "activating expectations about dogs just as he might if he saw a dog."<sup>75</sup> Conceptualization for the sighted seems to be a very natural yet defined process. Even the conflict over functional cores is solved through maturation. While the sighted do not show any indication of problems in processing or in interpreting the basic concepts pertaining to the self or environment, blind children are not so fortunate.<sup>76</sup>

Piaget emphasizes the importance of an infant's interaction with the environment and the dependence on vision for this interaction.<sup>77</sup> The blind child's "cognitive and adaptive needs are more difficult to meet. A large portion of learning that comes through detected observation may never appear in the child's repertoire if supplementary exercises and information are not provided."<sup>78</sup> Visual impairment handicaps the child from acquiring information about the environment by severing the dominant sensory modality. The knowledge received from the remaining senses too often is "incomplete, imperfect, and only a rough approximation of what is learned through the sense of sight."<sup>79</sup> The solid base of experiences that the blind child demands for understanding frequently is incomplete. Sighted persons tend to possess "unspoken assumptions" about an object or event which may be clarified only through vision. To the blind child outside of the visual relationship between the self and the event, the resulting image is insufficient-- "the manner in which the blind process personal and environmental information appears to result in fragmented and distorted understandings of simple, straight-forward concepts."<sup>80</sup>

One example of the problematic conceptualization in blind children is the "House Concept" (Figure 2). "The outer structure of the house (walls and roof) is mentioned by the sighted children at all age levels. The blind children, on the other hand, began at age five by mentioning the door and at age six the door and roof. By age seven, the blind children had omitted the door as a priority response, and walls and roof became the preferred response. The sighted group, in contrast, by age seven had completed the physical structure of the house." Even more demonstrative is the idea that the blind children concentrated their attention on their own bedrooms, while

the sighted children shared their focus between the kitchen and bedroom. This distinction illustrates the demand for first-hand experiences in cognitive development.<sup>81</sup>

As the blind are denied many aspects of experiences ultimately inhibiting cognitive growth, they rarely develop a "frame of reference" in which to code and store "internal representations of objects." Persons without a frame of reference have a distinct type of symbol structure. When a new object is introduced solely its relationship to other objects will be remembered--a spatio-relational storage of stimuli. If the object cannot be related to past experiences in this way, the idea is abandoned. Again, the necessity of empirical encounters is emphasized.

Social education, the third factor in mental development encompasses dependency, language, social interaction, and social transmission.<sup>82</sup> From birth the blind infant is dependent upon the mother or security figure more than the sighted infant for initial orientation to people and the environment. With age, this dependency expands to include the reliance upon others for explanations, discriminations, and qualifications of external stimuli; thus, the blind "develop concepts through the eyes of others."<sup>83</sup> The continuous in-take of second-hand information generates frustration towards differentiating the child's own thoughts and those of others.<sup>84</sup> One consequence of the dependency on others is that verbalization or language may be more vital to the blind child than to the sighted.<sup>85</sup>

Observation and experience is the basis of language. Language is constructed by sighted people; yet, the blind individual's methods of communicating conceptual and perceptual reality are quite distinct from the sighted.<sup>86</sup> Common speech forms "transmit much more than words; [they transmit]

hidden baggage of shared assumptions, a 'collective consciousness that constitutes a social bond.'<sup>87</sup> This "hidden baggage" presents serious problems for the blind. Often, the content within the language cannot be understood outside of the abstract assumptions and the blind do not share this relationship. R. B. LePage states, "Language is not primarily a means of communication, but a means of communion. Communion denotes sharing; however, the blind are not full recipients of this phenomenon. In a sense, language emancipates people by allowing them to send unlimited signals. Conversely, it enslaves individuals by "forcing them to communicate [their] thoughts in a regulated way."<sup>88</sup>

The growth and development of language is strongly linked to the growth and development of concepts. Beginning with the identification of concrete objects and events, language progresses to describing feelings and attitudes, then finally to the understanding of abstract ideas.<sup>89</sup> Not only must the blind child expand his/her language abilities so that new experiences can be understood totally through language, but he/she must perfect his/her proficiency for using language as the "primary referent" for receiving and accepting concepts.<sup>90</sup> The relationship between concept development and language learning begins with word cognition.

For all children, "learning a word . . . is like fitting a stone into the appropriate place in a mosaic."<sup>91</sup> Word acquisition is an elaborate synthesis between the child's perceptual/conceptual development and lexical development.<sup>92</sup> "The linguistic sign unites, not a thing and a name, but a concept and a sound image. The latter is not a material sound, a purely physical thing, but the psychological imprint of the word."<sup>93</sup> Learning a word assumes the existence of a blueprint of thoughts and experiences.<sup>94</sup>

This frame of reference is obtained via the kinesthetic, auditory, and visual sensory avenues. An integration or flexible meshing of these modalities promotes word recognition.

Word recognition in the child may be viewed as having three stages, each of which is enumerated below.

1. Stimulus presentation  
printed stimulus as it appears in a book.
2. Cue selection--discrimination learning  
may be in terms of a letter, word, shape;  
any characteristics to set the word apart.
3. Visual recognition memory  
select a cue--recognize again.
4. Repertoire availability  
must be available for hook up with cue  
increase through the control of the context.
5. Hook up or associative stage  
cue and appropriate response. Learner  
should be able to read and recognize the  
word.<sup>95</sup>

These early stages of word identification and understanding are dominated by the necessity of pictorial aids or visual representations to identify, distinguish, and remember the referents. Without the reinforcement of vision, "confusion between the spoken word and the meaning of the word as related to phenomenological experiences" frequently occurs.<sup>96</sup> Below are listed a number of illustrations summing up the incongruity of word cognition in blind children.

Matthew (six years four months) eats a potato crisp, one of which is curved. He says, "It is like a mouth."

Alan (six years eight months) shakes a tin box and is for a long time absorbed in the sound he is making. He finally said, "It sounds like people clapping."

Alan (seven years eight months) uses a paper puncher and remarks, "It is as if I am taking a picture."<sup>97</sup>

Recognizing that names of words symbolize either objects or events is confirmation of the formation of meaning acquisition.<sup>98</sup> Knowing the meaning of a word is to be elucidated in terms of [recognizing] the concept which it expresses, denotes, names . . ."<sup>98</sup> To achieve the liason between a word and its meaning, the child must be exposed to as many situations as are applicable to the usage of the word. As experience was tied so closely to concept development in general, there exists a very strong conviction that meaning and experience also are interrelated; that "experience is permeated by meaning."<sup>99</sup> Dependence on the environment for the significance of words is not unavoidable, it is imperative to the language development of the child. The context in which the word is introduced accentuates the kinds of choices for meaning which will be featured; hence, the broad concept will be effected.<sup>100</sup> If context plays such a vital role in the derivation of word meaning, consider the handicap of visual impairment in identifying the setting which is to give meaning to a word.

Vygotsky states of a sighted child prior to concept formation. "The child's and the adult's words coincide in referents but not in meanings; the reverse is true for blind children."<sup>101</sup> Visual impairment can either make words meaningless or it can simply alter the meaning. Consequently, concepts may be completely or partially misunderstood. "Words may be used merely to imitate or to parrot the sighted."<sup>102</sup> "Word calling" in the blind, when the person can recognize a word but has no significance to attach to it, is analogous to the imitative behavior previously described. The blind individual does not lack the ability to make associations when exhibiting "word calling;" the experiences and direct interactions necessary for discerning meaning are not present.<sup>103</sup> The dilemma between words and meanings



has been referred to as the "intolerable wrestle."<sup>104</sup> Unfortunately, the price to be paid for losing the "match" is the isolation of the blind child.

In terms of affiliating linguistic symbols with meaning, relational words probably are the most difficult for the blind child to comprehend. Relational words "big, little," "tall, short" rely on either the environment or the child him/herself to function as an "implicit standard for size." To understand the meaning correctly, the child must identify qualifying properties of the object and he/she must compare the object to some standard. Consider the comparison of a "big" elephant to a "big" ant. The differing standards of size make the relationship between the two difficult to conceptualize--a "little elephant is considerably larger than "biggest" ant. For relational words, the child's "linguistic knowledge must be mapped onto [his/her] conceptual knowledge about spatial relationships."<sup>105</sup> Teaching these concepts to the blind can be difficult; yet, with a combination of explanation and experiential activities, the relationship can be understood. The concept "parallel" may be taught in three steps. First, explain that "parallel" is defined as side by side, not touching, equidistant at all points. Second, give the child two rulers and ask him/her to place them in a parallel position. Third, pick up familiar objects with parallel features--sides of a desk, sides of a hallway, grasslines along a walkway.<sup>106</sup> Following these stages, the blind child should have a general idea of the term "parallel" upon which he/she can add experiences and new information.

The most complex of relational words for the blind are "deictic expressions." These terms call on the listener to locate the object in reference to the speaker. Examples of deictic expressions include "this,

that, here and there." The child must employ the words "in accordance with the shifting criteria of distance" since many depend on "individual viewpoints as well as implicit standards of distance for interpretation." Problems arise in blind children when "here" shifts to "there" as the context of the conversation changes.<sup>107</sup> The task increases in difficulty when the child attempts to translate the speaker's statement into his/her own perspective:

"This" building for speaker may be  
 "This" building for listener if both are in roughly the  
 same location.

"That" statue for speaker may be  
 "This" statue for listener if he/she is standing next  
 to it while speaker is some distance away.<sup>108</sup>

Vague meaning is inherent for deictic expressions. The solution is to present the blind child with as many experiences as possible which incorporate these concepts. Only then will he/she understand the abstract ideas and the language that describes them.<sup>109</sup> Another strategy for assisting the child is increased verbalization. Encouraging the blind child to inquire about the relationships between him/herself to an object will help to make the abstract more concrete.

In a sense, blindness inspires verbalization. Blind children frequently try to "make up with words for what he/she does not see. He/she finds uses for speech that the seeing do not require; that is, for orientation, to collect characteristics for differentiating between persons, to discover some mark by which an object can be recognized. He asks questions, the main object of which is to get clues."<sup>110</sup> The use of language as a substitute for visual experiences often leads to "verbalisms" in blind children.<sup>111</sup> Significantly linked to a lack of experience, verbalisms are

discrepancies between a word and its sensory experience.<sup>112</sup> More accurately, verbalisms are "a blind person's use of words whose meanings can be understood only through vision. . . a blind person can have no understanding of such terms. . . ."113

Color words serve as a good example of verbalisms since blindness inhibits the chances to acquire concepts such as color and perspective.<sup>114</sup> For the blind, color cannot be experienced at all-- through any of the sensory modalities.<sup>115</sup> Nevertheless, the conceptual development for color words has three elements. First, the blind child must be able to distinguish colors from other characteristics such as size, shape, or texture. Second, he/she should be able to separate primary colors. This may be accomplished by touching the object and detecting the temperature--dark colors insulate heat and lighter colors reflect the heat. Third, the child should be able to identify other colors with respect to the primary colors. Awareness of the placement of the primary colors on a continuum or spectrum will enable the blind child to imagine the color "puce" if he/she was instructed that "puce" was between red and purple.<sup>116</sup> Possessing the ability to connect some semblance of meaning to abstract concepts such as verbalism is frustrating for the blind child but essential for successful integration into the sighted world.

Equilibration is the fourth factor in mental development. Specifically, equilibration is "a self-regulatory mechanism of mental development, [resulting] from a series of compensations on the part of the learner as he/she responds to external stimuli. The resulting adjustment is based upon previous learning . . . [and upon] motivation and values."<sup>117</sup> General information and research are limited for the impact of this fourth stage in the development in the congenitally blind child. One study was conducted by Stephens

and Simpkins (1974) entitled The Reasoning, Moral Judgment, and Moral Conduct of the Congenitally Blind illustrates the involvement of maturation, experience, and social interaction on equilibration.

In stories involving falsehoods, the subject was to consider intention versus consequence in determining the gravity of the fabrication. One such moral judgment assessment involved stories of two boys. In the first story, the boy intentionally gave wrong directions to a man, but, despite the misinformation, the man did not get lost. In the comparison story, a boy who had just moved to town gave a man what he thought were correct directions, but they were incorrect and the man got lost. The blind subjects generally decided the second situation was more serious, regardless of the positive intentions of the boy. Although responses of blind subjects indicated some consideration of intention versus consequence, the exceedingly traumatic interpretation the blind subjects gave to being lost probably influenced the final response.<sup>118</sup>

Referring back to the maturation, experience, and social learning components of equilibration, the responses of the blind subjects can be understood more easily when considering the interaction of these factors. First, it is an outstanding achievement for the blind child to become "oriented to and mobile in [his/her] environment." Second, resulting from the dependency on others for security, there is a tremendous fear of being lost. Third, the blind child, like any individual, will seek help only from those people that he/she trusts.<sup>119</sup> It should be obvious that the affective and cognitive factors are inseparable in light of this notion of equilibration.

As evidenced by the extensive information on the unparalleled cognitive development between blind and sighted children, the restrictions placed on the blind for concept formation and maturation should be overtly clear subsequent problems in language, abstract and concrete thinking as well as conceptualization of the self and environment call attention to additional limitations.

The influence of blindness on general perception of experiences, concept attainment, conceptual development, motor development, language, word cognition and meaning, and Piagetian stages has been discussed extensively. In all of these areas, there is definite developmental asynchrony due to the lack of vision and which the other modalities do not compensate for. "The congenitally blind child does not have vision to "facilitate even his most basic developments . . . [he/she] must coordinate all development and learning through the remaining senses."<sup>120</sup>

Interaction between the blind child and the environment may be perceived aurally, through sound discrimination, localization and obstacle detection and also compressed speech.<sup>121</sup> "Auditory cues help the blind baby in attaining degree of spatial orientation . . . , their inconstancy must make the process exceedingly difficult, when compared with the sighted child who has constant visual information at his disposal."<sup>122</sup> Sight pertains to tangible experiences. Auditory acuity in the blind attempts to locate and discriminate these experiences although it is limited as a sensory avenue. Actually, hearing offers little knowledge about the objective world and recognizes a purely audile environment.<sup>123</sup>

Perception of the world gained through the sense of touch distinguishes pattern and form.<sup>124</sup> From the tactile data, the blind strive to create a visual image of the object; however, touching is helpful only for objects which a child can have first-hand contact with and those objects that can withstand manipulation.<sup>125</sup> Understanding the concept "round" is not easy for the blind child. Unless the illustrative object may be contained entirely in the child's hand, he/she will not always identify it as round. Additional examples are given below.

Gillian (five and a half years) swings around the teacher. The teacher mentions she is going around in a circle, and Gillian asks, "What is a circle?" This is explained by feeling around an object. "but how can I go in a circle?"

Winnie (three years and one month) plays with sand for the first time and lets it run through her fingers. She says, "Sugar."<sup>126</sup>

The inadequacy of tactile experiences for a blind child's definitions of labelings of objects and events is clarified by the statements above. To address this idea of the dominance of vision over tactile/kinesthetic handling in the area of perception, Kinney and Luria (1970) conducted extensive research.

"The relative importance placed on visual rather than tactual or kinesthetic cues was investigated under water." Water served as the setting because it is a natural environment which provides contradictory stimulation to tactual and visual senses. Specifically, tactual perception is constant in air or in water. Conversely, visual stimuli is altered in the water as the result of the light rays refracting as they move from water to air. Subjects participated in a task requiring the matching of coins under water. Consistently, subjects retrieved disks which were much smaller than the true size of the coins and "more closely approximating their optical size in the water."<sup>127</sup> Kinney and Luria's research contributes greatly to modality perception. If the preferred modality for identification of objects seems to be vision, then the blind receive only a fragmented view of the world which no other sense can compensate for.

Recognizing developmental lags and cognitive gaps as well as differences in image formation may lead to a better understanding of the

specific deficiencies in symbolic reasoning apparent to many blind children."<sup>128</sup> To make maximum use out of the senses remaining to the blind child, numerous experiential approaches must be presented. These children need exposures which permit them "to develop mental operations including skills of perceptual discrimination and association, recognition of positional and spatial relationships, closure, constancy, figure ground, memory, convergent and divergent thinking, and evaluation."<sup>129</sup> In essence, the task is to understand the blind child's conceptions of his/her surroundings so that occasions may be provided in which they can fulfill their potential.<sup>130</sup>

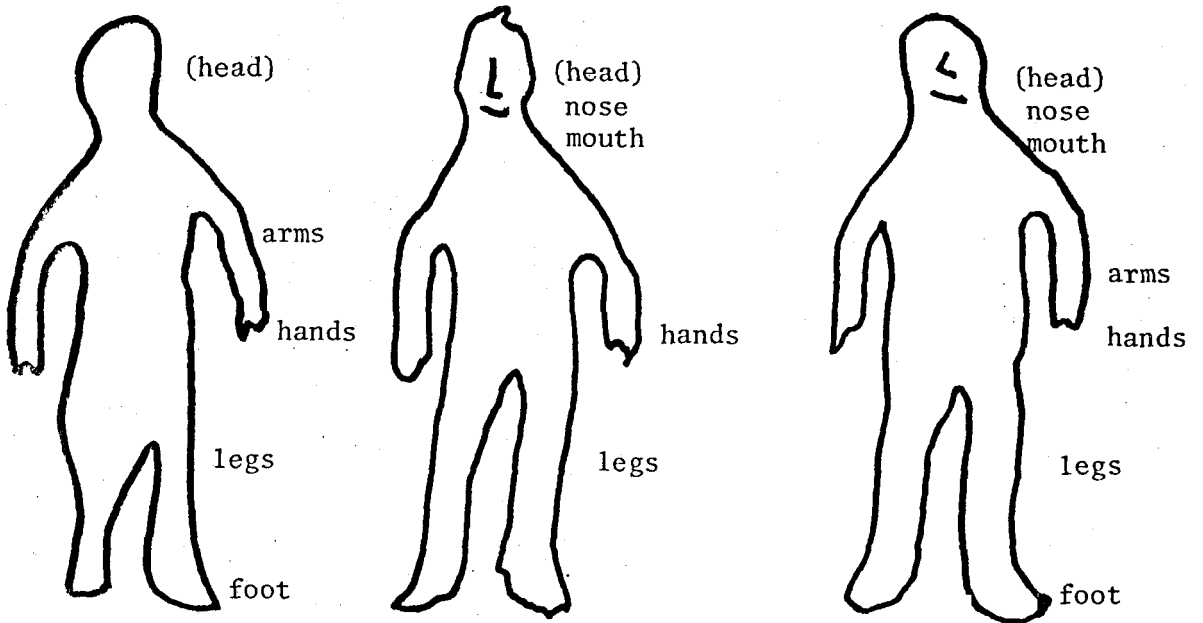
Children

5 years

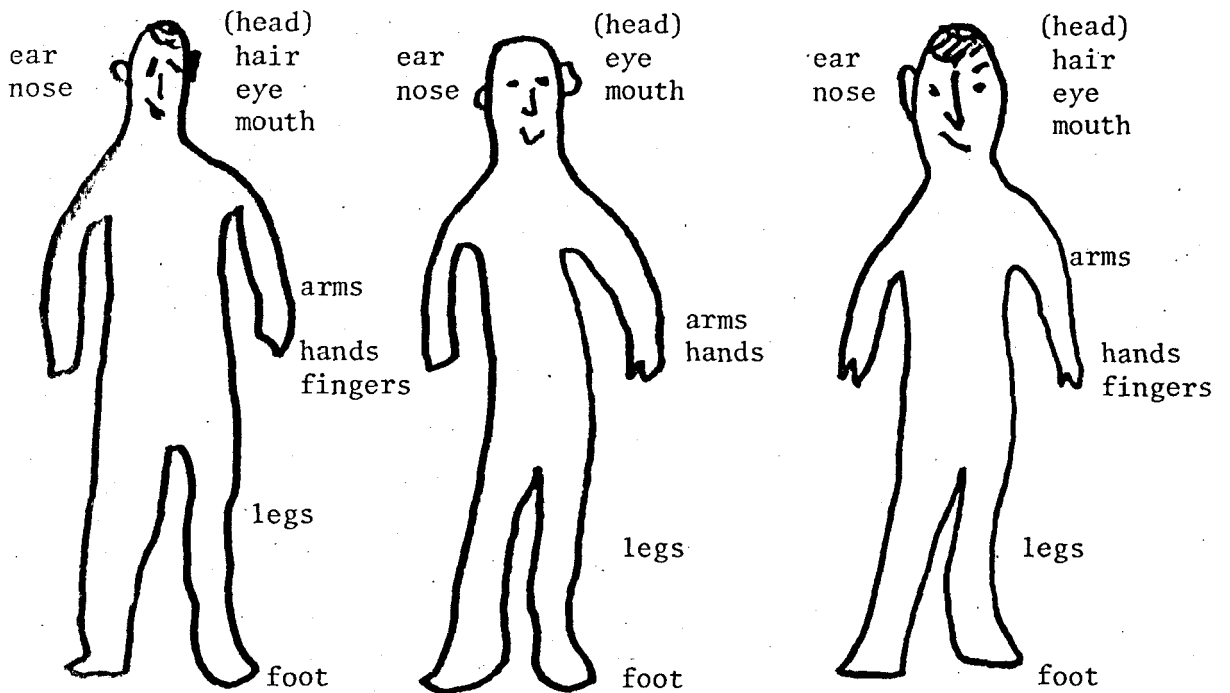
6 years

7 years

Blind



Sighted



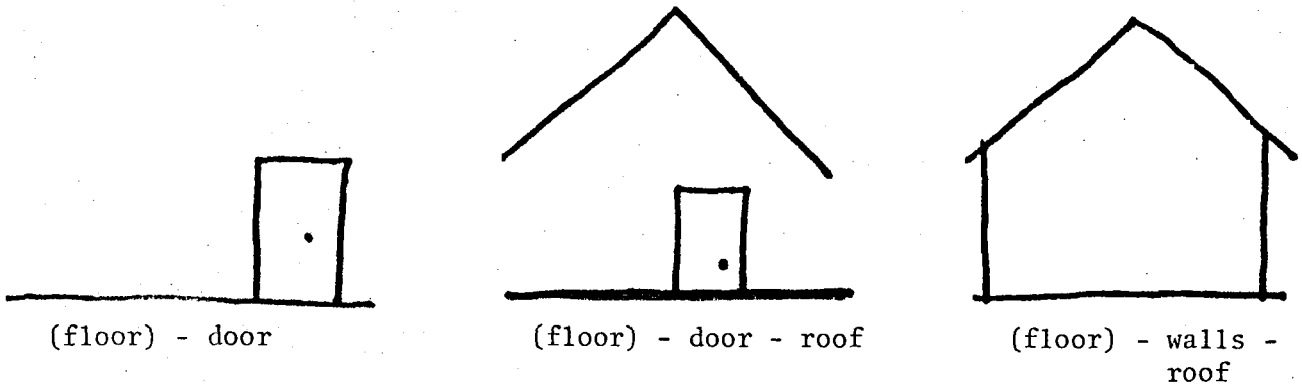
SOURCE: Swallow, Rose-Marie. "Piaget's Theory and the Visually Handicapped Learner." New Outlook for the Blind, 70, No. 7 (1976), 273-281.



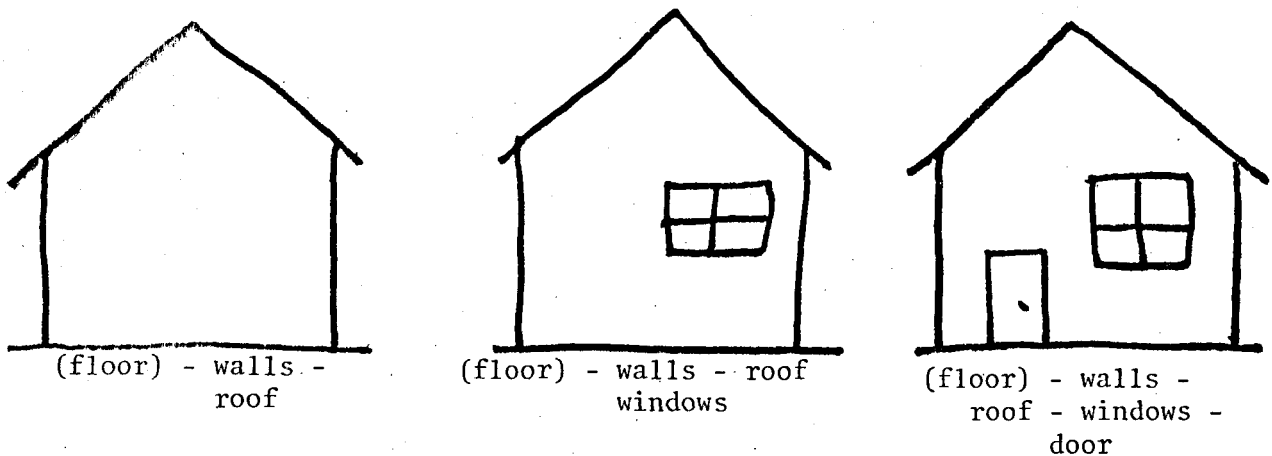
Children      5 years                      6 years                      7 years

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### Blind



### Sighted



Note: This figure is based upon priority responses: that is, those items which were mentioned by 50 percent or more of the children within each age group (blind 5, 6, and 7 years and sighted 5, 6, and 7). In all groups the floor was given in the lead question and it is included in parentheses and is not to be considered as a priority response.

SOURCE: Swallow, Rose-Marie. "Piaget's Theory and the Visually Handicapped Learner." New Outlook for the Blind, 70, No. 7 (1976), 273-281.

## ENDNOTES

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<sup>2</sup>Rebecca F. DuBose, "Developmental Needs in Blind Infants," New Outlook for the Blind, 70, No. 2 (1976), p. 51.

<sup>3</sup>John G. Kephart, Christine P. Kephart, and George C. Swarz, "A Journey into the World of Blind Children," Exceptional Children, 40, No. 6 (1976), p. 422.

<sup>4</sup>Eissler, XVI, p. 121.

<sup>5</sup>Barry Hampshire, "Language and Cognitive Development in the Blind Child," Education of the Visually Handicapped, 9, No. 4 (1978), p. 98.

<sup>6</sup>David H. Warren, Blindness and Early Childhood Development (New York: American Foundation for the Blind, Inc., 1977), p. 84.

<sup>7</sup>*Ibid.*, p. 86.

<sup>8</sup>Leslie B. Cohen, "Our Developmental Knowledge of Infant Perception and Cognition," American Psychologist, 34, No. 10 (1979), p. 898.

<sup>9</sup>*Ibid.*, p. 894.

<sup>10</sup>Roth S. Eissler, Anna Freud, Heinz Hartmann, and Marianne Kris, Psychoanalytic Study of the Child, XIX (New York: International University, 1964), p. 96.

<sup>11</sup>Gesell et al, cited in Eissler, XIX, p. 96.

<sup>12</sup>Eissler, XIX, p. 110.

<sup>13</sup>Kephart, p. 421.

<sup>14</sup>Warren, Blindness and Early Childhood Development, p. 87.

<sup>15</sup>Peter H. Martonella, Concept Learning: Design for Instruction (Scranton: Intext Publishing, 1972), p. 1.

<sup>16</sup>John Macnamara, Language Learning and Thought (New York: Academic Press, 1977), p. 134.

<sup>17</sup>Ibid.

<sup>18</sup>Ibid., p. 131.

<sup>19</sup>Ibid.

<sup>20</sup>Kent Tyler Wardell, "Assessment of Blind Students' Conceptual Understanding," New Outlook for the Blind, 69 (1975), p. 445.

<sup>21</sup>I. Zweibelson and C. Fisher Barg, ed., "Concept Development of Blind Children," New Outlook for the Blind, 61 (1967), p. 218.

<sup>22</sup>Jill G. deVilliers and Peter A. deVilliers, Language Acquisition (Cambridge: Harvard University Press, 1978), p. 124.

<sup>23</sup>Milton Gottesman, "Stage Development of Blind Children: A Piagetian View," New Outlook for the Blind, 70, No. 3 (1976), p. 99.

<sup>24</sup>Milton Gottesman, "A Comprehensive Study of Piaget's Development Schema of Sighted Children with that of a Group of Blind Children," Child Development, 4, No. 2 (1971), p. 573.

<sup>25</sup>David H. Warren, "Blindness and Early Development: What is Known and What Needs to be Studied," New Outlook for the Blind, 70, No. 1 (1976), p. 10.

<sup>26</sup>Hampshire, p. 99.

<sup>27</sup>Warren, Blindness and Early Childhood Development, p. 102.

<sup>28</sup>Geraldine T. Scholl, The Principal Works of the Visually Impaired (Washington: National Education Association, 1968), p. 14.

<sup>29</sup>Warren, Blindness and Early Childhood Development, p. 13.

<sup>30</sup>Kephart, p. 421.

<sup>31</sup>Judith Friedman and Robert Pasnak, "Attainment of Classification and Seriation Concepts by Blind & Sighted Children," Education of the Visually Handicapped, 5, No. 2 (1973), p. 55.

<sup>32</sup>Zweibelson, p. 218.

<sup>33</sup>Warren, Blindness and Early Childhood Development, p. 119.

<sup>34</sup>Ibid. Herman A. Witkin, Judith Birnbaum, Salvatore Lomonaco, Suzanne Lehr, and Judith Herman, "Cognitive Patterning in Congenitally Totally Blind Children," Child Development, 39 (1968), p. 768.

<sup>35</sup>Witkin, p. 768.

<sup>36</sup>Ibid.

<sup>37</sup>Hampshire, p. 101.

<sup>38</sup>Warren, Blindness & Early Childhood Development, p. 89.

<sup>39</sup>Daniel B. Juliano, "A Developmental State of Conceptual Tempo, Conceptual Learning, and Abstraction," Journal of Psychology, 96 (1977), p. 244.

<sup>40</sup>Warren, Blindness and Early Childhood Development, p. 119.

<sup>41</sup>L. S. Vygotsky, Thought and Language (Massachusetts: M.I.T. Press, 1962), p. 9.

<sup>42</sup>Gottesman, "Stage Development," p. 94.

<sup>43</sup>Susanna Whitney Pflaum, The Development of Language and Reading in Young Children (Columbus: Charles E. Merrill Publishing Co., 1974), p. 4.

<sup>44</sup>Ibid., p. 5.

<sup>45</sup>Friedman, p. 55.

<sup>46</sup>Rose-Marie Swallow, "Piaget's Theory and the Visually Handicapped Learner," New Outlook for the Blind, 70, No. 7 (1976), p. 270.

<sup>47</sup>Ibid., p. 275.

<sup>48</sup>Hampshire, p. 99.

<sup>49</sup>Ibid., p. 97; Warren, Blindness and Early Childhood Development, p. 84.

<sup>50</sup>Warren, Blindness and Early Childhood Development, p. 85.

<sup>51</sup>Ibid., p. 86.

<sup>52</sup>Ibid.

<sup>53</sup>Ibid.

<sup>54</sup>Hampshire, p. 99.

<sup>55</sup>Ibid.

<sup>56</sup>Warren, Blindness and Early Childhood Development, p. 95.

<sup>57</sup>Ibid.

<sup>58</sup>Ibid.

<sup>59</sup>Swallow, p. 275.

<sup>60</sup>Hampshire, p. 100.

- <sup>61</sup>Inhendler and Piaget, cited in Swallow, p. 275.
- <sup>62</sup>Swallow, p. 275.
- <sup>63</sup>Warren, Blindness and Early Childhood Development, p. 88.
- <sup>64</sup>Ibid.
- <sup>65</sup>Gottesman, "Stage Development," p. 94.
- <sup>66</sup>Swallow, p. 275.
- <sup>67</sup>Halliday, p. 203.
- <sup>68</sup>Warren M. Brodey, "Experimental Education of the Blind Important for Teaching the Gifted," Gifted Child Quarterly, 6, No. 4 (1962), p. 142.
- <sup>69</sup>Sally M. Rogow, "Language Acquisition and the Blind Retarded Child," Education of the Visually Handicapped, 4, No. 2 (1972), p. 37.
- <sup>70</sup>Pflaum, 38.
- <sup>71</sup>Sally M. Rogow, "Speech Development and the Blind Multi-Impaired Child," Education of the Visually Handicapped, 5, No. 4 (1973), p. 108.
- <sup>72</sup>Pflaum, p. 38.
- <sup>73</sup>Macnamara, p. 118.
- <sup>74</sup>Ibid., p. 128.
- <sup>75</sup>Ibid., p. 124.
- <sup>76</sup>Kephart, p. 427.
- <sup>77</sup>Warren, Blindness and Early Childhood Development, p. 85.
- <sup>78</sup>DuBose, p. 51.
- <sup>79</sup>Scholl, pp. 14-15.
- <sup>80</sup>Kephart, p. 427.
- <sup>81</sup>Swallow, p. 280.
- <sup>82</sup>Ibid., p. 277.
- <sup>83</sup>Scholl, p. 14.
- <sup>84</sup>Warren, Blindness and Early Childhood Development, p. 88.

<sup>85</sup>Ibid., p. 83.

<sup>86</sup>Zweibelson, p. 218.

<sup>87</sup>Halliday, p. 26.

<sup>88</sup>Fred West, The Way of Language: An Introduction (New York: Harcourt, Brace, and Jovanovich, 1975), p. 171; M. Bloomfield and E. Haugen, eds., Language as a Human Problem (New York: W. W. Norton and Co., 1974) p. 5.

<sup>89</sup>Josephine Stratton, The Blind Child in the Regular Kindergarten (Illinois: Charles C. Thomas, 1977), p. 10.

<sup>90</sup>Ibid., p. 11.

<sup>91</sup>Katz from Vendler's Res Cognitans, cited in David E. Cooper, Knowledge of Language (New York: Humanities Press, Inc., 1975), p. 146.

<sup>92</sup>deVilliers, p. 122.

<sup>93</sup>Macnamara, p. 171.

<sup>94</sup>Cooper, p. 146.

<sup>95</sup>Robert B. Ruddell and Harry Singer, Theoretical Models and Processes of Reading (Newark: International Reading Association, 1976), p. 271.

<sup>96</sup>Zweibelson, p. 218.

<sup>97</sup>Eissler, XVI, p. 138.

<sup>98</sup>Cooper, p. 145.

<sup>99</sup>Samuel Guttenplan, Mind and Language (Oxford: Claredon Press, 1975), p. 25.

<sup>100</sup>Halliday, p. 26.

<sup>101</sup>Zweibelson, p. 221.

<sup>102</sup>Eissler, XVI, p. 134.

<sup>103</sup>Ruddell, p. 313.

<sup>104</sup>Annette Karmiloff-Smith, A Functional Approach to Language (New York: Cambridge University Press, 1979), p. 22.

<sup>105</sup>deVilliers, p. 123.

- 106Wardell, p. 445.
- 107deVilliers, p. 124.
- 108Ibid.
- 109Stratton, p. 11.
- 110Eissler, XVI, p. 134.
- 111Hampshire, p. 99.
- 112Swallow, p. 280; DeMott, p. 1.
- 113Stratton, p. 11.
- 114Scholl, p. 14.
- 115Warren, Blindness and Early Childhood Development, p. 83.
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- 121Edward C. Carterette and Martha P. Friedman, eds., Handbook of Perception, X (New York: Academic Press, 1978), pp. 66-73.
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